

The rejection objects to the term "prodrugs" in the claims and asserts that the specification does not describe how to make or use such prodrugs sufficiently to enable one skilled in the art to do so. The comments in the Office Action indicate a clear misunderstanding of the nature of the claimed invention. The inventors are not claiming to have invented any new prodrugs. Nor are they claiming any way of making any new prodrugs. Prodrugs of the anthracyclines and mitoxantrone and the ways of making and using them are well known to persons skilled in the art and are considered within the skill of the art. Instead, the invention relates to a method of alleviating problems and difficulties which are known to occur with the use of cardiotoxic medicaments, including already well known and widely used prodrugs of the anthracyclines and mitoxantrone. The rejected claims merely give these compounds as examples of known cardiotoxic medicaments.

As evidence that the anthracyclines, mitoxantrone and prodrugs of these substances are well known to persons skilled in the art, submitted herewith are eight pages of results from a computerized search of the technical literature for relevant published articles. The list commences with four lengthy review articles summarizing the known state of the art relating to anthracycline prodrugs followed by an abstract of an article dealing with prodrugs of mitoxantrone, as well as references to 10 of 28 articles referring to prodrugs of daunorubicin, references to 10 of 77 articles dealing with prodrugs of doxorubicin, references to 10 of 11 articles dealing with prodrugs of adriamycine and references to three

articles dealing with prodrugs of epirubicin. These literature references clearly establish that the prodrugs of the anthracyclines and mitoxantrone are well known to persons skilled in the art.

It is also known in the art that the anthracyclines and mitoxantrone, as well as their known prodrugs, exhibit oxidative-cytotoxic side effects. Importantly, no reason is seen why a person skilled in the art should have any difficulty practicing the claimed invention of alleviating these known side effects by administering an effective side effect inhibiting amount of a compound corresponding to formula I as described and claimed in the instant application. Applicants therefore respectfully submit that their claimed invention is fully enabled to a person skilled in the art, and reconsideration and withdrawal of the rejection are respectfully requested.

In view of the foregoing, all claims of the application are respectfully submitted to be in condition for allowance, and prompt, favorable action thereon is earnestly solicited.

If there are any questions regarding this reply or the application in general, a telephone call to the undersigned at (202)624-2845 would be appreciated since this should expedite the prosecution of the application for all concerned.


If necessary to effect a timely response, this paper should be considered as a petition for an Extension of Time sufficient to effect a timely response, and

Application No. 10/043,268
Reply to Office Action
December 2, 2004

please charge any deficiency in fees or credit any overpayments to Deposit
Account No. 05-1323 (Docket #029300.50827US).

Respectfully submitted,

December 2, 2004



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Registration No. 26,269

Attachment: Literature Search Results (8 pages)

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selectivity)
IT ***20830-81-3*** , Daunorubicin
RL: THU (Therapeutic use); BIOL (Biological study); USES (Uses)
(***prodrug*** of ***anthracycline*** that include **daunorubicin**
was enzymically activated using endogenous and nonendogenous enzymes
and development of ***prodrugs*** has been successful but with lack
of complete selectivity)
IT ***23214-92-8*** , Doxorubicin
RL: THU (Therapeutic use); BIOL (Biological study); USES (Uses)
(***prodrug*** of ***anthracycline*** that include **doxorubicin**
was enzymically activated using endogenous and nonendogenous enzymes
and development of ***prodrugs*** has been successful but with lack
of complete selectivity)
IT ***56420-45-2*** , Epirubicin
RL: THU (Therapeutic use); BIOL (Biological study); USES (Uses)
(***prodrug*** of ***anthracycline*** that include **epirubicin**
was enzymically activated using endogenous and nonendogenous enzymes
and development of ***prodrugs*** has been successful but with lack
of complete selectivity)
RE.CNT 337 THERE ARE 337 CITED REFERENCES AVAILABLE FOR THIS RECORD
ALL CITATIONS AVAILABLE IN THE RE FORMAT

L12 ANSWER 2 OF 4 HCAPLUS COPYRIGHT 2004 ACS on STN
AN 2003:824354 HCAPLUS
DN 140:174228
TI **Selective activation of anthracycline prodrugs for use in conjunction with ADEPT**
AU HariKrishna, D.; Rao, A. Raghu Ram; Krishna, D. R.
CS Department of Medicinal Chemistry, Kakatiya University, Warangal, 506 009, India
SO **Drug News & Perspectives** (2003), 16(5), 309-318
CODEN: DNPEED; ISSN: 0214-0934
PB Prous Science
DT Journal; ***General Review***
LA ***English***
AB **A review.** A major limitation in the chemotherapy of cancer results from the lack of tumor specificity displayed by most anticancer drugs. In this regard, a great deal of research has been focused on the development of new chemotherapeutic agents that are able to effectively exploit the differences between neoplastic and normal tissues. Several cancerous tissues and tumors are rich in certain lysosomal enzymes as compared with those found in the normal tissues. Thus, a **prodrug** can be designed to selectively target such tumor cells where it can be activated to antineoplastic agent by tumor-assocd. antigen-targeted monoclonal antibody-enzyme conjugate (antibody directed enzyme **prodrug** therapy (ADEPT) strategy) or by the action of an enzyme present at high levels in tumor tissues (**prodrug** monotherapy strategy). This approach protects the normal cells from the cytotoxic effects of the drug. In the last few years, a no. of new MAb-based reagents has been clin. approved (Rituxan, Herceptin and Panorex), and several others are now in advanced clin. trials. This review focuses on the design of several different enzyme/**prodrug** combinations with an emphasis on mechanistic insight and clin. activity.
CC 1-0 (Pharmacology)
Section cross-reference(s): 63
IT Antitumor agents
Human
(antitumor ***anthracycline*** ***prodrug*** selective

activation for use in conjunction with antibody-directed enzyme
*****prodrug***** therapy)
IT *****Anthracyclines*****
Enzymes, biological studies
RL: DMA (Drug mechanism of action); THU (Therapeutic use); BIOL
(Biological study); USES (Uses)
(antitumor *****anthracycline***** *****prodrug***** selective
activation for use in conjunction with antibody-directed enzyme
*****prodrug***** therapy)
IT Antibodies and Immunoglobulins
RL: DMA (Drug mechanism of action); THU (Therapeutic use); BIOL
(Biological study); USES (Uses)
(monoclonal; antitumor *****anthracycline***** *****prodrug*****
selective activation for use in conjunction with antibody-directed
enzyme *****prodrug***** therapy)
IT Drug delivery systems
(*****prodrugs***** ; antitumor *****anthracycline***** *****prodrug*****
selective activation for use in conjunction with antibody-directed
enzyme *****prodrug***** therapy)
RE.CNT 53 THERE ARE 53 CITED REFERENCES AVAILABLE FOR THIS RECORD
ALL CITATIONS AVAILABLE IN THE RE FORMAT

L12 ANSWER 3 OF 4 HCAPLUS COPYRIGHT 2004 ACS on STN
AN 2001:263606 HCAPLUS
DN 135:70474
TI Novel **anthracycline prodrugs**
AU Damen, Eric W. P.; De Groot, Franciscus M. H.; Scheeren, Hans W.
CS Department of Organic Chemistry, NSR Center for Molecular Structure,
Design and Synthesis, University of Nijmegen, Nijmegen, 6525 ED, Neth.
SO **Expert Opinion on Therapeutic Patents** (2001), 11(4), 651-666
CODEN: EOTPEG; ISSN: 1354-3776
PB Ashley Publications Ltd.
DT Journal; ***General Review***
LA ***English***
AB A review with 92 refs. This paper highlights recent patents in the field
of **anthracycline prodrugs**, which are employed in tumor-selective
chemotherapy. The **prodrugs** can be a part of a two-step directed enzyme
prodrug therapy (DEPT), which involves the localization of the **prodrug**
trigger at the tumor site, followed by the administration of the **prodrug**
and subsequent tumor-selective **anthracycline** release. In most cases this
trigger is an enzyme, which is indirectly localized by an antibody (ADEPT)
or a gene encoding for an enzyme (GDEPT). Furthermore, **anthracyclines** can
be targeted to the tumor site via **prodrug** monotherapy. **Anthracycline**
prodrugs exploiting differences in physiol. conditions, such as a lower pH
and a lower oxygen tension in tumor tissue compared to healthy tissue,
tumor-specific enzymes, such as plasmin, cathepsin B and
.beta.-glucuronidase are discussed. Finally, **prodrugs** are reviewed that
home to tumor-selective receptors. Promising advances in this field
concern receptors that are required for angiogenesis.
CC 1-0 (Pharmacology)
IT Antitumor agents
(novel *****anthracycline***** *****prodrugs*****)
IT *****Anthracyclines*****
RL: BAC (Biological activity or effector, except adverse); BSU (Biological
study, unclassified); THU (Therapeutic use); BIOL (Biological study); USES
(Uses)
(novel *****anthracycline***** *****prodrugs*****)
IT Drug delivery systems

(*****prodrugs***** ; novel *****anthracycline***** *****prodrugs*****)
IT Angiogenesis
(receptors required for; novel *****anthracycline***** *****prodrugs*****
)
RE.CNT 45 THERE ARE 45 CITED REFERENCES AVAILABLE FOR THIS RECORD
ALL CITATIONS AVAILABLE IN THE RE FORMAT

L12 ANSWER 4 OF 4 HCAPLUS COPYRIGHT 2004 ACS on STN
AN 2000:308690 HCAPLUS
DN 133:135474
TI **Prodrugs of natural anthracyclines suited for antibody directed enzyme
prodrug therapy (ADEPT) and prodrug monotherapy (PMT)**
AU Michel, S.; Desbene, S.; Gesson, J.-P.; Monneret, C.; Tillequin, F.
CS Laboratoire de Pharmacognosie, U.R.A. au C.N.R.S. N 1310, Paris, 75270,
Fr.
SO Studies in Natural Products Chemistry (2000), 21(Bioactive Natural
Products (Part B)), 157-180
CODEN: SNPCE2
PB Elsevier Science B.V.
DT Journal; *****General Review*****
LA *****English*****
AB **A review with 76 refs.** The chem. efficacy of most anticancer agents,
including **anthracyclines** such as **daunorubicin** and **doxorubicin**, is severely
hampered by general toxicity and by the appearance of acquired resistance.
The Antibody Directed-Enzyme **Prodrug** Therapy (ADEPT) concept aims at
modifying the distribution of such drugs. It entails the use of an
enzyme-antibody conjugate targeted towards the tumor cell surface, in
conjunction with a non-cytotoxic **prodrug**, which can be converted upon
enzyme activation, into the cytotoxic species. By this way, high local
concn. of drug can be specifically obtained at the tumor site, resulting
in decreased general toxicity, when compared with classical chemotherapy.
We report here the synthesis and biol. behavior of triparte **prodrugs** in
which an osidic specifier is linked to the primary amino function of an
thracycline through a self-immolative ortho- or para-hydroxybenzyl
connector. This spacer can undergo spontaneous 1,4- or 1,6-elimination,
after enzymic cleavage of the specifier, to generate the free
anthracycline. Para-hydroxybenzyl glucuronic **prodrugs** of **doxorubicin**,
exhibited strongly reduced cytotoxicity when compared to the parent drug
and efficiently released **doxorubicin** upon cleavage by a fusion protein
consisting of the humanized anti-carcinoembryogenic monoclonal antibody
and of the non-circulating human .beta.-D-glucuronidase. Injection of
prodrug alone into animals bearing necrotic tumors resulted in therapeutic
effects superior to conventional chemotherapy, as a consequence of
selective activation by .beta.-D-glucuronidase liberated in necrotic
areas. This latter observation recently led to the new concept of **prodrug**
monotherapy (PMT).
CC 33-0 (Carbohydrates)
Section cross-reference(s): 1, 7, 63
IT Antibodies
RL: BPR (Biological process); BSU (Biological study, unclassified); BIOL
(Biological study); PROC (Process)
(monoclonal; *****prodrugs***** of natural *****anthracyclines*****
suited for antibody directed enzyme *****prodrug***** therapy (ADEPT)
and *****prodrug***** monotherapy (PMT))
IT Antitumor agents
Chemotherapy
Cytotoxic agents
Cytotoxicity

Therapy
(*****prodrugs***** of natural *****anthracyclines***** suited for
antibody directed enzyme *****prodrug***** therapy (ADEPT) and
*****prodrug***** monotherapy (PMT))
IT *****Anthracyclines*****
RL: BAC (Biological activity or effector, except adverse); BSU (Biological
study, unclassified); SPN (Synthetic preparation); BIOL (Biological
study); PREP (Preparation)
(*****prodrugs***** of natural *****anthracyclines***** suited for
antibody directed enzyme *****prodrug***** therapy (ADEPT) and
*****prodrug***** monotherapy (PMT))
IT Drug delivery systems
(*****prodrugs***** ; *****prodrugs***** of natural
*****anthracyclines***** suited for antibody directed enzyme
*****prodrug***** therapy (ADEPT) and *****prodrug***** monotherapy
(PMT))
RE.CNT 76 THERE ARE 76 CITED REFERENCES AVAILABLE FOR THIS RECORD
ALL CITATIONS AVAILABLE IN THE RE FORMAT

2) Citations and Titles: individual Substances

A) MITOXANTRON

L14 ANSWER 1 OF 1 HCAPLUS COPYRIGHT 2004 ACS on STN
AN 1994:638252 HCAPLUS
DN 121:238252
TI Incorporation of lipophilic *****prodrugs***** of ametantrone and
mitoxantrone inside low density lipoproteins (LDL) and selective uptake of
the *****prodrug***** LDL complex via the LDL receptor pathway
AU Monard-Herkt, F.; Teissier-Morier, E.; Favre, G.; Samadi-Baboli, M.;
Soula, G.; Houssin, R.; Bernier, J. L.; Henichart, J. P.; Martin-Nizard,
F.; et al.
CS Pasteur Institute, Lille, Fr.
SO **Acta Therapeutica** (1993), 19(4), 317-35
CODEN: ACTTDZ; ISSN: 0378-0619
DT ***Journal***
LA English
AB Low-d. lipoprotein (LDL) particles are potential drug carriers, but only
lipophilic drug species partition into the core of the system. In this
study, ametantrone (AQ) and mitoxantrone (DHAQ) have been coupled to
different fatty acids (stearate, palmitate, oleate, linolenate). The
linolenate esters of AQ and DHAQ incorporate in highest concn. into LDL
using the following protocol of incubation. The **prodrug** (dilinolenate of
DHAQ) was dissolved in Intralipid (a parental triglyceride rich emulsion)
and then incubated with LDL and lipoprotein deficient serum or albumin for
18 h at 37.degree.C. This method provides substantial incorporation of
dilinolenate-DHAQ into LDL (26 mols. of dilinolenate-DHAQ per LDL
particle). The dilinolenate-DHAQ-LDL complex was recognized by
apolipoprotein B and E receptors, in vitro and in vivo in the rabbit. The
pharmacol. efficiency of both free dilinolenate-DHAQ and
dilinolenate-DHAQ-LDL complex was 1000 times less cytotoxic on A 549, A
431 and L 1210 cells than free DHAQ. We conclude that this method of
incorporation allows the incorporation of a consistent concn. of **prodrug**
inside LDL and prevents aggregation of the lipoprotein during the prepn.
of the **prodrug**-LDL complex. This complex is incorporated into the cell
both in vitro and in vivo via the LDL receptor pathway.
CC 63-5 (Pharmaceuticals)

IT 158439-18-0P 158439-19-1P 158439-20-4P 158439-21-5P 158439-22-6P
158439-23-7P 158439-24-8P 158439-25-9P ***158439-26-0P***
RL: SPN (Synthetic preparation); THU (Therapeutic use); BIOL (Biological study); PREP (Preparation); USES (Uses)
(incorporation of lipophilic *****prodrugs***** of ametantrone and
mitoxantrone inside low d. lipoproteins)
IT 64862-96-0D, Ametantrone, fatty acid esters *****65271-80-9D***** ,
Mitoxantrone, fatty acid esters
RL: THU (Therapeutic use); BIOL (Biological study); USES (Uses)
(incorporation of lipophilic *****prodrugs***** of ametantrone and
mitoxantrone inside low d. lipoproteins)

B) DAUNORUBICIN

Wenn Du zugehörige Abstracts haben möchten, bitte melden!

L15 ANSWER 1 OF 28 HCAPLUS COPYRIGHT 2004 ACS on STN
TI Extracellular .beta.-glucuronidase for gene-directed enzyme-
*****prodrug***** therapy

L15 ANSWER 2 OF 28 HCAPLUS COPYRIGHT 2004 ACS on STN
TI Cytosolic .beta.-glycosidases for activation of glycoside *****prodrugs*****
of **daunorubicin**

L15 ANSWER 3 OF 28 HCAPLUS COPYRIGHT 2004 ACS on STN
TI Enzyme-activated *****prodrug***** therapy enhances tumor-specific
replication of adenovirus vectors

L15 ANSWER 4 OF 28 HCAPLUS COPYRIGHT 2004 ACS on STN
TI PDEPT: polymer-directed enzyme *****prodrug***** therapy. I. HPMA
copolymer-cathepsin B and PK1 as a model combination

L15 ANSWER 5 OF 28 HCAPLUS COPYRIGHT 2004 ACS on STN
TI Drug delivery systems based on trimethyl lock lactonization:
Poly(ethyleneglycol) *****prodrugs***** of amino-containing compounds

L15 ANSWER 6 OF 28 HCAPLUS COPYRIGHT 2004 ACS on STN
TI Melanocyte-Directed enzyme *****prodrug***** therapy (MDEPT). Development
of second generation *****prodrugs***** for targeted treatment of
malignant melanoma

L15 ANSWER 7 OF 28 HCAPLUS COPYRIGHT 2004 ACS on STN
TI A **daunorubicin** .beta.-galactoside *****prodrug***** for use in conjunction
with gene directed enzyme *****prodrug***** therapy

L15 ANSWER 8 OF 28 HCAPLUS COPYRIGHT 2004 ACS on STN
TI Intensely cytotoxic **anthracycline** *****prodrugs***** : galactosides

L15 ANSWER 9 OF 28 HCAPLUS COPYRIGHT 2004 ACS on STN
TI Drug Delivery Systems Based on Trimethyl Lock Lactonization: Poly(ethylene
glycol) *****Prodrugs***** of Amino-Containing Compounds

L15 ANSWER 10 OF 28 HCAPLUS COPYRIGHT 2004 ACS on STN
TI Synthesis and Biological Evaluation of Novel *****Prodrugs***** of
Anthracyclines for Selective Activation by the Tumor-Associated Protease
Plasmin

C) DOXORUBICIN

- L16 ANSWER 1 OF 77 HCAPLUS COPYRIGHT 2004 ACS on STN
TI LEAPT: Lectin-directed enzyme-activated *****prodrug***** therapy
- L16 ANSWER 2 OF 77 HCAPLUS COPYRIGHT 2004 ACS on STN
TI Engineering a thermostable human prolyl endopeptidase for antibody-directed enzyme *****prodrug***** therapy
- L16 ANSWER 3 OF 77 HCAPLUS COPYRIGHT 2004 ACS on STN
TI *****Prodrug***** chemotherapeutics bypass p-glycoprotein resistance and kill tumors in vivo with high efficacy and target-dependent selectivity
- L16 ANSWER 4 OF 77 HCAPLUS COPYRIGHT 2004 ACS on STN
TI Plasmin-activated **doxorubicin** *****prodrugs***** containing a spacer reduce tumor growth and angiogenesis without systemic toxicity
- L16 ANSWER 5 OF 77 HCAPLUS COPYRIGHT 2004 ACS on STN
TI Pronounced Antitumor Efficacy by Extracellular Activation of a **Doxorubicin**-Glucuronide *****Prodrug***** After Adenoviral Vector-Mediated Expression of a Human Antibody-Enzyme Fusion Protein
- L16 ANSWER 6 OF 77 HCAPLUS COPYRIGHT 2004 ACS on STN
TI **Doxorubicin** *****prodrug***** on the basis of tert-butyl cephalosporanate sulfones
- L16 ANSWER 7 OF 77 HCAPLUS COPYRIGHT 2004 ACS on STN
TI Bioactivation of Self-Immolative Dendritic *****Prodrugs***** by Catalytic Antibody 38C2
- L16 ANSWER 8 OF 77 HCAPLUS COPYRIGHT 2004 ACS on STN
TI Extracellular .beta.-glucuronidase for gene-directed enzyme-*****prodrug***** therapy
- L16 ANSWER 9 OF 77 HCAPLUS COPYRIGHT 2004 ACS on STN
TI A New Aliphatic Amino *****Prodrug***** System for the Delivery of Small Molecules and Proteins Utilizing Novel PEG Derivatives
- L16 ANSWER 10 OF 77 HCAPLUS COPYRIGHT 2004 ACS on STN
TI HPLC-MS/MS determination of a peptide conjugate *****prodrug***** of **doxorubicin**, and its active metabolites, leucine-doxorubicin and **doxorubicin**, in dog and rat plasma

D) ADRIAMYCIN

- L17 ANSWER 1 OF 11 HCAPLUS COPYRIGHT 2004 ACS on STN
TI A New Aliphatic Amino *****Prodrug***** System for the Delivery of Small Molecules and Proteins Utilizing Novel PEG Derivatives
- L17 ANSWER 2 OF 11 HCAPLUS COPYRIGHT 2004 ACS on STN
TI Enhanced antitumor efficacy of an albumin-binding **doxorubicin** *****prodrug***** designed to be cleaved by matrix metalloproteinase 2
- L17 ANSWER 3 OF 11 HCAPLUS COPYRIGHT 2004 ACS on STN
TI Overexpression of Legumain in Tumors Is Significant for

Invasion/Metastasis and a Candidate Enzymatic Target for ***Prodrug*** Therapy

- L17 ANSWER 4 OF 11 HCAPLUS COPYRIGHT 2004 ACS on STN
TI Activation of Adriamycin by the pH-dependent Formaldehyde-releasing ***Prodrug*** Hexamethylenetetramine
- L17 ANSWER 5 OF 11 HCAPLUS COPYRIGHT 2004 ACS on STN
TI Molecular basis for the synergistic interaction of adriamycin with the formaldehyde-releasing ***prodrug*** pivaloyloxymethyl butyrate (AN-9)
- L17 ANSWER 6 OF 11 HCAPLUS COPYRIGHT 2004 ACS on STN
TI Elongated Multiple Electronic Cascade and Cyclization Spacer Systems in Activatable Anticancer ***Prodrugs*** for Enhanced Drug Release
- L17 ANSWER 7 OF 11 HCAPLUS COPYRIGHT 2004 ACS on STN
TI Synthesis and Biological Evaluation of Novel ***Prodrugs*** of Anthracyclines for Selective Activation by the Tumor-Associated Protease Plasmin
- L17 ANSWER 8 OF 11 HCAPLUS COPYRIGHT 2004 ACS on STN
TI Intensely Cytotoxic Anthracycline ***Prodrugs*** : Glucuronides
- L17 ANSWER 9 OF 11 HCAPLUS COPYRIGHT 2004 ACS on STN
TI Monomethoxytrityl (MMT) as a versatile amino protecting group for complex ***prodrugs*** of anticancer compounds sensitive to strong acids, bases and nucleophiles
- L17 ANSWER 10 OF 11 HCAPLUS COPYRIGHT 2004 ACS on STN
TI Targeting of macromolecular ***prodrug*** to T-lymphocytes

E) EPIRUBICIN

- L18 ANSWER 1 OF 3 HCAPLUS COPYRIGHT 2004 ACS on STN
TI Extracellular .beta.-glucuronidase for gene-directed enzyme-***prodrug*** therapy
- L18 ANSWER 2 OF 3 HCAPLUS COPYRIGHT 2004 ACS on STN
TI Simultaneous high-performance liquid chromatographic determination of a glucuronyl ***prodrug*** of doxorubicin, doxorubicin and its metabolites in human lung tissue
- L18 ANSWER 3 OF 3 HCAPLUS COPYRIGHT 2004 ACS on STN
TI A new application for liposomes in cancer therapy. Immunoliposomes bearing enzymes (immuno-enzymosomes) for site-specific activation of ***prodrugs***